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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

## In the Matter of

# Amendment of Part 90 of the Commission's Rules to Adopt Regulations for Automatic Vehicle Monitoring Systems

) PR Docket No. 93-61  
) RM-8013

## REPLY COMMENTS OF THE TIA MOBILE & PERSONAL COMMUNICATIONS CONSUMER RADIO SECTION

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## TABLE OF CONTENTS

<b>SUMMARY .....</b>	<b>iii</b>
<b>I. INTRODUCTION .....</b>	<b>1</b>
<b>II. THERE NOW IS GENERAL RECOGNITION THAT PART 15 DEVICES POSE A SERIOUS INTERFERENCE PROBLEM FOR WIDE-AREA AVM/LMS SYSTEMS .....</b>	<b>2</b>
A. MobileVision Provides an Extensive Analysis Verifying the Interference Problem .....	2
B. Teletrac Has Implicitly Acknowledged the Interference Problem .....	7
<b>III. THERE REMAIN FUNDAMENTAL UNRESOLVED TECHNICAL ISSUES AND DISAGREEMENTS AMONG WIDE-AREA AVM/LMS INTERESTS THAT REQUIRE RESOLUTION IN AN INDUSTRY STANDARDS FORUM .....</b>	<b>9</b>
<b>IV. CONCLUSION .....</b>	<b>10</b>

## SUMMARY

The TIA Mobile & Personal Communications Consumer Radio Section ("the Section") respectfully offers its reply comments in response to a Public Notice ("Notice") issued by the Commission requesting comments on Ex Parte presentations made in association with the above-referenced proceeding. Having reviewed the twenty-two sets of Comments filed in response to the Notice, the Section finds that:

1. There is growing agreement that the potential for interference from Part 15 devices to wide-area Automatic Vehicle Monitoring/Location and Monitoring Services ("AVM/LMS") systems is significant and cannot be ignored. In particular, MobileVision L.P. ("MobileVision") included with its comments an attachment showing an extensive set of case-by-case calculations of interference between various types of Part 15 devices and AVM/LMS systems. The conclusions reached are largely consistent with the Section's earlier findings that FCC-authorized Part 15 devices pose a serious interference problem for the reliable operation of wide-area AVM/LMS systems in the 902-928 MHz band. In addition, Pactel Teletrac ("Teletrac") has finally acknowledged (albeit implicitly) that interference from Part 15 devices might cause a problem for its system. As a remedy, both MobileVision and Teletrac propose what amounts to a de facto segmentation of the 902-928 MHz band.
2. The four wide-area AVM/LMS proponents do not seem to be converging toward agreement on a band plan and a set of operating rules. It is evident that each has developed a different technological solution to the problem of wide-area vehicle location, and accordingly, each continues to advocate a band plan that will favor its own technology and its own private interests as opposed to the public interest. It would seem that the only solution that would not favor one or two of the current incumbents at the expense of the others would be to preserve the current interim rules while the FCC undertakes a further review of appropriate spectrum for AVM/LMS systems.
3. There are a number of technical issues that do not seem to be well-understood or agreed upon among the wide-area interests. These include such things as the feasibility of band sharing, and the capacity gains associated with bandwidth increases.

4. Given the current directions of the wide-area interests, there would seem to be little hope of ultimate interoperability or compatibility among their systems, although the Section believes that such interoperability would serve the public interest.

It is becoming increasingly clear that wide-area AVM/LMS systems and Part 15 devices cannot coexist harmoniously in the 902-928 MHz band. The de facto band segmentation solutions suggested by MobileVision and Teletrac are unacceptable because they are inconsistent with the existing structure of the Commission's rules in §15.247 governing spread spectrum Part 15 devices in the Industrial, Scientific, and Medical ("ISM") bands. As stated in the Notice of Proposed Rule Making ("NPRM") which initiated the instant proceeding, changes to the Part 15 rules are not within the scope of the proceeding. If the fostering of reliable wide-area AVM/LMS systems is judged to be in the public interest, the Commission should allocate a suitable block of clear spectrum to those systems. As discussed by the Section and others in their recently-submitted comments on this proceeding, some of the spectrum blocks identified by the National Telecommunications and Information Administration ("NTIA") earlier this year appear to be promising candidates for wide-area AVM/LMS applications.

It also is clear at this point that the Commission's review and comment process is not the appropriate forum in which to debate the merits of various technical solutions to the wide-area location and monitoring problem. An industry forum is needed in which wide-area AVM/LMS proponents can conduct detailed interactive discussions of the outstanding technical issues and develop recommendations to the Commission and industry standards for the operation of wide-area AVM/LMS systems. Even given the allocation of clear spectrum for these systems, the Section does not believe that the public interest is well-served by a variety of technically diverse and operationally incompatible solutions. The existing cellular industry serves as a model for the manner in which multiple equipment manufacturers and service providers can work cooperatively to develop standards that allow interoperability between service areas and promote the scale economies that minimize system component costs and maximize equipment and service availability. If AVM/LMS systems and services are to form a part of the National Information Infrastructure ("NII") and are necessary to support IVHS services, then interoperability becomes a key concern.

Given the state of the proceeding as summarized by the above points, the Section believes that the public interest would be best served by termination of this proceeding. There is no reason to believe that further cycles of comments or Ex Parte presentations would support any significant progress toward resolving the outstanding technical issues among the wide-area AVM/LMS providers. Moreover, without resolution of these issues, the Commission lacks a factual basis upon which to make a responsible decision. The Section therefore urges the Commission to terminate this proceeding and “grandfather” existing AVM systems, allowing their continued operation under the current interim rules while (1) initiating a search for suitable clear spectrum to allocate to wide-area AVM/LMS systems, and (2) encouraging wide-area AVM/LMS interests to work cooperatively in an appropriate industry standards forum to resolve the outstanding technical issues and develop recommendations for FCC rules and industry standards to govern operation of AVM/LMS systems. During this process, a moratorium should be imposed on the construction of new equipment and the granting of new licenses for wide-area AVM/LMS systems.

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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

**BEFORE THE  
FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON D. C. 20554**

In the Matter of

Amendment of Part 90 of the  
Commission's Rules to Adopt  
Regulations for Automatic  
Vehicle Monitoring Systems

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)  
) PR Docket No. 93-61  
) RM-8013  
)

To: The Commission

**REPLY COMMENTS**

**I. INTRODUCTION**

1. The Telecommunications Industry Association ("TIA") Mobile & Personal Communications Consumer Radio Section ("the Section") hereby offers its Reply Comments in response to a Public Notice ("Notice") issued by the Commission<sup>1</sup> requesting Comments on Ex Parte presentations associated with the above-referenced proceeding.

2. Upon review of the twenty-two sets of comments filed in response to the Notice, the Section finds that while some issues have been clarified, others remain hopelessly unresolved. As discussed herein, there now seems to be general recognition of the fact that Part 15 devices as authorized under §15.247 of the Commission's rules, and wide-area Automatic Vehicle Monitoring/Location and

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1. FCC Public Notice DA 94-129, February 9, 1994.

Monitoring Services (“AVM/LMS”) systems as proposed by Teletrac, MobileVision, Southwestern Bell Mobile Systems (“SBMS”), and Pinpoint Communications, Inc. (“Pinpoint”) cannot harmoniously coexist in the 902-928 MHz band. However, it also is clear that the differences among these four wide-area AVM/LMS interests with respect to the band plan and operating rules are irresolvable within the context of the Commission’s Notice and Comment process.

## **II. THERE NOW IS GENERAL RECOGNITION THAT PART 15 DEVICES POSE A SERIOUS INTERFERENCE PROBLEM FOR WIDE-AREA AVM/LMS SYSTEMS**

### **A. MobileVision Provides an Extensive Analysis Verifying the Interference Problem**

3. In Annex 2 of its comments, MobileVision provides an extensive case-by-case analysis of the potential for interference between various types of Part 15 devices and various categories of AVM/LMS radio links, as well as among Part 15 devices. MobileVision’s calculations are largely consistent with those provided by the Section in Exhibit A of its comments, and show that in many cases Part 15 devices can cause substantial interference to wide-area AVM/LMS systems.<sup>2</sup> MobileVision categorizes Part 15 devices according to whether they operate indoors or outdoors, and according to whether they are designed to comply with §15.247 or §15.249 of the Commission’s rules.

4. After analyzing the potential for interference from indoor Part 15 devices, MobileVision concludes that, “indoor Part 15.247 radios could cause a 10 to 20 dB desensitization of the LMS fixed site if they are within 1 mile of the LMS site.”<sup>3</sup> In its summary of the interference from indoor Part 15 devices, MobileVision states that “There is a possibility that indoor Part 15.247 devices, operating within a mile of a wideband LMS fixed site, will desensitize that site by 20 dB, effectively reducing its range by a factor of 3.”<sup>4</sup>

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2. See, for example, MobileVision Annex 2 at pp. 10, 23, and 32.

3. MobileVision Annex 2 at p. 11.

4. MobileVision Annex 2 at p. 21.

5. From its analysis of interference to LMS from outdoor Part 15 devices, MobileVision concludes that “Any outdoor Part 15 device, within 3.6 miles of an LMS receiving site could desensitize that site by 20 dB. This is very significant interference and is potentially disastrous [sic] for the LMS system.”<sup>5</sup> The assumptions used by MobileVision (regarding propagation, power levels, building penetration loss, etc.) in its calculations of interference from Part 15 devices to LMS appear reasonable and the Section generally agrees with the resulting conclusions; i.e., FCC-authorized Part 15 devices can pose a serious interference problem for wide-area AVM/LMS systems.

6. MobileVision also provides a general discussion of Part 15 device characteristics and potential solutions to the interference problems. Unfortunately, MobileVision’s understanding of Part 15 devices appears incomplete, and as a result, its proposed solutions are impractical. While §15.247 allows both direct sequence and frequency hopping signal formats, MobileVision focuses primarily on direct sequence systems in its analysis. For example, MobileVision states that “The outdoor Part 15 radio is usually a wideband device of about 4-6 MHz.”<sup>6</sup> It is unclear how MobileVision came to this conclusion. However, it is a fact that there already is a substantial deployment of outdoor frequency hopping Part 15 radios,<sup>7</sup> and the proliferation of frequency hoppers, both indoor and outdoor, will continue. MobileVision focuses on the disadvantages of direct sequence Part 15 devices in terms of interference rejection and spectrum efficiency.<sup>8</sup> While it is true that the use of direct sequence modulation generally is not a spectrum-efficient solution for unlicensed applications,<sup>9</sup> this bears on the susceptibility of the Part 15 devices to interference from other sources, not their ability to cause interference to

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5. MobileVision Annex 2 at p. 23 (emphasis added).

6. MobileVision Annex 2 at p. 27.

7. See, for example, the Comments of Metricom, Inc. (“Metricom”) at pp. 2 and 21-25.

8. See MobileVision Annex 2 at pp. 37-41.

9. In contrast, the use of direction sequence modulation can support spectrum-efficient operation in a centrally-controlled, coordinated system via code-division multiple access (CDMA), as is specified in TIA’s IS-95 Interim Standard for wideband digital cellular systems.



LMS receivers. Indeed, the greater the bandwidth over which a given radiated power is “spread,” the lower the spectral power density of the signal, and the less interference it will cause to systems of narrower bandwidth. In fact, the entire discussion in MobileVision’s Annex 2 of interference to Part 15 devices, both from LMS systems and from other Part 15 devices, is irrelevant to this proceeding. Part 15 device manufacturers enter the market with the knowledge that their systems will be operating in an environment subject to random uncontrolled interference from various sources. To provide reliable communication, Part 15 devices must be designed for robust operation in that environment. To some extent, the fitness of a Part 15 design can be measured by how well it can cope with the interference that will increasingly characterize the 902-928 MHz band.

7. As the Commission is well aware, compliance with §15.247 of its rules necessarily requires a Part 15 device to radiate over a bandwidth that is significantly greater than the “information bandwidth.”<sup>10</sup> Because of the relatively large bandwidth available in the 902-928 MHz band, such operation is practical, and is specifically allowed under the FCC rules. However, one of the solutions proposed by MobileVision amounts to a de facto band segmentation. That is, MobileVision would eliminate interference problems by restricting Part 15 devices to less than the entire band. For example, under “Recommendations” in its Annex 2, MobileVision proposes that “Part 15.247 radios should be able to simply be set to channels in the center of the band, i.e., 912-918 MHz.”<sup>11</sup>

8. This proposal is inconsistent with the requirements in §15.247. For frequency hopping Part 15 devices, §15.247 requires that the transmitter continuously hop among 50 randomly-selected frequencies. The maximum allowed bandwidth per hopping channel is 500 kHz. Hence, a system that needs to transmit at a high rate and uses the 500 kHz maximum hopping channel bandwidth is required to hop over a total bandwidth of 25 MHz, or effectively the entire 902-928 MHz band. Similarly, a direct sequence system transmitting 1 Mb/s with a modulation

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10. Loosely stated, the “information bandwidth” might be viewed as the bandwidth required to transmit the signal using a conventional narrowband digital modulation such as frequency-shift keying (“FSK”) or phase-shift keying (“PSK”).

11. MobileVision Annex 2 at p. 4.

efficiency of 1 bit/second/Hz would need a clear radio frequency (“RF”) bandwidth of roughly 10 MHz due to the minimum 10 dB processing gain required by §15.247. Such systems obviously could not operate under MobileVision’s proposal and remain in compliance with §15.247. While a device with smaller bandwidth requirements (e.g., a frequency hopper with a 100 kHz hopping channel bandwidth) might be able to contain its signal within the 912-918 MHz band and still hop among 50 frequencies,<sup>12</sup> it would have little or no freedom to escape from interfering signals within that band. The point is that the viability of spread spectrum systems operating within the 902-928 MHz band depends on the freedom of the designer to use frequency agility to avoid interference by moving away from it, thereby eliminating interference to the Part 15 device as well as the interfering device.<sup>13</sup>

9. Other “remedies” discussed by MobileVision are the use of directional antennas,<sup>14</sup> and moving out of the 902-928 MHz band altogether. Indeed, in its “Recommendations” in Annex 2, MobileVision states that “When intended for long distance links, the Part 15.247 device should be encouraged onto the 2400 and 5800 MHz bands where there is more usable bandwidth and there is the potential for designing devices with reasonable jamming margin.”<sup>15</sup> While the use of

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12. Clearly, a random selection of 50 hopping frequencies would not generally result in a signal confined to the 912-918 MHz band. Hence, a device systematically choosing all 50 frequencies from within the 912-918 MHz band would violate the requirements of §15.247.

13. Unfortunately, such frequency agility usually will not do much to reduce the potential for interference from the Part 15 device to a wide-area AVM/LMS base station. This is because the signal from the AVM/LMS mobile transmitter is typically of short duration (on the order of milliseconds or tens of milliseconds), relatively low power, wideband, and may be emanating from a far-away mobile. The energy from such a signal into the intermediate frequency (“IF”) passband of the Part 15 device typically will not be sufficiently high to trigger the interference-avoidance mechanism. A Part 15 device near a wide-area AVM/LMS base station therefore can cause substantial interference to the base station receiver (as shown by MobileVision) without being “aware” that the band is in use.

14. See, for example, MobileVision Annex 2 at pp. 4, 29, 32, 36, 42.

15. MobileVision Annex 2 at p. 42.

directional antennas may be practical for some cases in which fixed point-to-point links are used, they clearly are impractical for mobile or portable applications. Even in many point-to-point applications, directional antennas may be impractical due to the associated physical space requirements and/or the costs of the hardware, installation, and maintenance of alignment. Further, as both Part 15 devices and wide-area AVM/LMS installations proliferate, aligning directional antennas on a case-by-case basis will become a logistical nightmare. The Section therefore believes that while directional antennas may provide a solution in a few isolated cases, they cannot be viewed as a general remedy for interference from Part 15 devices to wide-area AVM/LMS systems.

10. MobileVision's suggestion of moving one of the applications out of the band does have merit. As for the suggestion that Part 15 devices be "encouraged onto" the two upper ISM bands near 2.4 and 5.8 GHz, the Section notes that ISM devices themselves, authorized as primary users of the band under Part 18 of the FCC rules, would still remain in the 902-928 MHz band and constitute significant potential sources of interference. The Section would suggest that as an alternative to MobileVision's proposal, a small portion of one of the upper ISM bands be considered for allocation to wide-area AVM/LMS systems. The 2.4 GHz band ranges from 2400 to 2483.5 MHz, and it would seem that a 10 MHz block of that band could be used for wide-area AVM/LMS systems with much less impact on other operations in the band than the allocation of a 10 MHz block in the 902-928 MHz band.

11. In sum, the Section finds that MobileVision's proposed "remedies" are inconsistent with the requirements of §15.247 and inconsistent with the characteristics of many existing and anticipated future Part 15 applications. Such measures would be tantamount to penalizing FCC-authorized Part 15 devices for the inherent lack of robustness that characterizes the wide-area AVM/LMS systems currently operating under the interim rules.

### **B. Teletrac Has Implicitly Acknowledged the Interference Problem**

12. Teletrac has long maintained that Part 15 devices do not constitute an interference threat to its systems. This claim clearly is inconsistent with the interference incident cited by Metricom and the Alarm Device Manufacturing Company (“Ademco”) in their comments.<sup>16</sup> Moreover, in its comments, while not offering evidence of the detailed analysis that MobileVision has conducted, Teletrac implicitly acknowledges the potential interference threat by proposing remedies similar to those suggested by MobileVision, stating that “problems can often be resolved through power reductions or the use of directional antennas.”<sup>17</sup> Teletrac even presumes to quantify “harmful interference,” proposing that “To enhance the stability of the Part 15 environment, Teletrac would support a definition for ‘harmful interference’ to be included in the rules.”<sup>18</sup> The definition offered by Teletrac is:

A Part 15 device will be considered a source of harmful interference if the signal level from that device exceeds the average interference and noise floor at an LMS receiver by more than 10 dB for more than 20% of the time over any 60 second period (10% if the signal exceeds the 10 dB limit at more than one LMS receiver).<sup>19</sup>

It is unclear how such a measure would “enhance the stability of the Part 15 environment.” However, when considered in light of MobileVision’s conclusions as discussed supra, such a definition clearly has severe implications on the continued freedom of Part 15 devices to operate in the 902-928 MHz band.

13. Teletrac goes on to state that:

In any event, Teletrac’s new sharing scheme would further improve the environment for Part 15 devices. Because wideband LMS systems are likely to gravitate to the 902-912 MHz band where they will receive

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16. See Metricom at pp. 8-9, Ademco at p. 6.

17. Teletrac at p. 10.

18. Id.

19. Id.

protection from narrowband system interference, Part 15 devices will have greater access to the remaining 16 MHz (and continue to be free to operate anywhere within the entire band on a noninterfering basis as they do now). Part 15 manufacturers can thus design devices to operate above 912 MHz with greater confidence about future usage of the band.<sup>20</sup>

This suggestion is similar in concept to Mobilevision's, and suffers from the same flaws. Further, as pointed out by a number of parties in their comments, Teletrac has not explained how its new proposal would "improve the environment" for Part 15 devices.<sup>21</sup> (This claim also was made by Teletrac in its January 26, 1994 Ex Parte memorandum.)

14. Although Teletrac's suggestions offer nothing in the way of a constructive solution for the problem of interference from Part 15 devices, they serve to confirm that Teletrac does indeed understand that its system cannot withstand such interference, and that Teletrac will need to have the option of exercising its prerogative as a Part 90 licensee to shut down or cripple interfering Part 15 transmitters. The conclusion is clear: wide-area AVM/LMS systems cannot harmoniously coexist with Part 15 devices in the 902-928 MHz band. The Commission therefore should identify a block of clear spectrum for allocation to wide-area AVM/LMS systems. As noted by several parties in their comments, the spectrum recently identified by the NTIA for reallocation to the private sector includes some bands that appear suitable for wide-area AVM/LMS.<sup>22</sup>

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20. Id.

21. See Cellnet Data Systems at p. 3; Symbol Technologies, Inc. at p. 2; the "ad hoc coalition of utility distribution companies" at p. 2; Knogo Corporation at p. 3; Itron, Inc. at p. 3; the Consumer Electronics Group of the Electronic Industries Association at p. 2; the Section at p. 8.

22. See, for example, the Part 15 Coalition at p. 4; the Section at pp. 9-10.

### **III. THERE REMAIN FUNDAMENTAL UNRESOLVED TECHNICAL ISSUES AND DISAGREEMENTS AMONG WIDE-AREA AVM/LMS INTERESTS THAT REQUIRE RESOLUTION IN AN INDUSTRY STANDARDS FORUM**

15. MobileVision, Pinpoint, SBMS, and Teletrac represent the wide-area AVM/LMS interests. Their systems are intended for vehicle location over a wide area. Each evidently has developed a different technological solution and therefore supports a band plan and operating rules that favor its own technology, at the expense of the others. In its comments, each concentrates on a number of issues that are fundamental to the operation of its system, such as the optimum bandwidth, the need for “housekeeping functions,” the need for a wideband forward link, the feasibility of two or more different systems time-sharing a single band, and the specific frequency band(s) that should be designated for wide-area systems. It is evident at this point that their debate over such issues could continue ad infinitum in the context of the Commission’s review and comment process without significant progress being made. The Section does not believe that such a continuation would be in the public interest, nor is it a worthwhile use of the Commission’s and the Industry’s resources.

16. Until some of these issues are conclusively resolved, however, the Commission will not have an adequate factual basis upon which to make a sound decision. Therefore, the Commission should encourage the wide-area AVM/LMS proponents to seek a forum in which the necessary technical debates and engineering groundwork can proceed on a cooperative basis, with the objective of developing recommendations for a band plan and a set of FCC rules to govern the operation of wide-area AVM/LMS systems.

17. It also is clear that with the current diversity of technical solutions proposed by the wide-area AVM/LMS interests, there is little or no hope of achieving the level of system compatibility needed to support interoperability (i.e., to allow “roaming”) and the scale economies necessary to minimize system component costs and allow the market to expand to its maximum potential. If AVM/LMS systems and services are to form a part of the National Information Infrastructure (“NII”) and are necessary support IVHS services, then interoperability becomes a key concern. The wide-area AVM/LMS interests therefore should work together to develop industry standards in much the same way as does the cellular industry.

18. As a part of this cooperative effort, work such as that described in the "Interim Progress Report" from the Mobile and Portable Radio Research Group at Virginia Tech ("the Virginia Tech report")<sup>23</sup> should continue in parallel. Such fundamental investigation at a technical level is necessary to resolve such issues as the benefits of increasing the bandwidth of wide-area AVM/LMS systems beyond 4 MHz in a multipath environment. Without it, the knowledge base necessary for the Commission to formulate an appropriate set of rules is incomplete.

#### **IV. CONCLUSION**

19. There are two firm conclusions that can be drawn from the record associated with this proceeding to date: (1) wide-area AVM/LMS systems cannot tolerate the interference that they would sustain from the Part 15 devices that are becoming increasingly common in the 902-928 MHz band, and (2) the dispute among wide-area AVM/LMS interests with respect to the band plan and operating rules cannot be resolved within the context of the Commission's Notice and Comment process. Since resolution of the heretofore unresolved technical issues is a prerequisite to a rational Rule Making, the Commission should encourage the wide-area AVM/LMS interests to work together cooperatively in the appropriate industry forum to develop recommendations for FCC rules as well as industry standards that will promote system compatibility and interoperability. This would appear to be of substantial benefit if AVM/LMS systems are to support IVHS services and the National Information Infrastructure. Moreover, if the Commission concludes that the availability of wide-area AVM/LMS of the type proposed by MobileVision, Pinpoint, SBMS, and Teletrac is in the public interest, it should begin the process of identifying a suitable block of clear spectrum to allocate to these services. The spectrum recently identified by NTIA for reallocation to the private sector appears to include some promising candidates.

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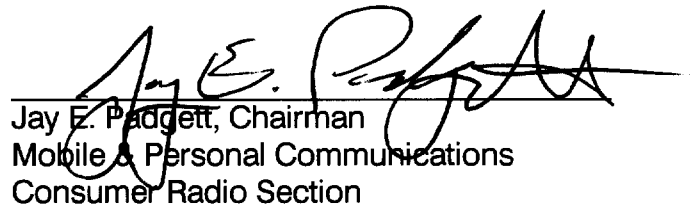
23. Provided by SBMS as an attachment to its February 2, 1994 Ex Parte letter, entitled "Capacity and Interference Resistance of Spread-Spectrum Automatic Vehicle Monitoring Systems in the 902-928 MHz ISM Band," by Rick Cameron and Brian D. Woerner, Mobile and Portable Radio Research Group, Bradley Department of Electrical Engineering, Virginia Tech, January 14, 1994.

20. The Section therefore urges the Commission to terminate this proceeding and "grandfather" existing AVM systems, allowing their continued operation under the current rules on an interim basis, while taking steps to identify spectrum for wide-area AVM/LMS, and encouraging cooperative work toward industry standards and recommendations for appropriate FCC rules. During this process, a moratorium should be imposed on the construction of new equipment and the granting of new licenses for wide-area AVM/LMS systems.

Respectfully submitted,

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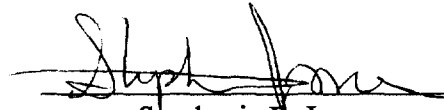
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Dated: March 29, 1994



CERTIFICATE OF SERVICE

I, Stephaine Jones, do hereby certify that on this the 29th day of March, 1994, a copy of the foregoing Comments was served by first class United States mail, postage prepaid, to the following parties.



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